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UNITED STATES DEPARTMENT OF AGRICULTURE
FOREST SERVICE
CENTRAL STATES FOREST EXPERIMENT STATION



ADDRESS REPLY TO
DIRECTOR
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INFORMATION
General

90 W. 10th AVENUE
103 18TH AVENUE,
COLUMBUS, OHIO

December 5, 1941.

Dear Sir:

At various times during the past two years, I have prepared papers or addresses for meetings, conferences, etc. Some people have requested that these things be given wider distribution; therefore, this compilation.

There is some duplication in thought among the papers, but they are each designed to present thoughts from different points of view to different audiences.

I would be happy to have your comments on:

- (1) The matters presented
- (2) The desirability of an occasional mimeographed release of this kind.

Sincerely yours,

J. ALFRED HALL,
Director

Enclosure



THE UNIVERSITY OF CHICAGO
DEPARTMENT OF CHEMISTRY

CHICAGO, ILL. 60637

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Changing a Poor Forest to a Good One

If a farmer had a field of corn choked with weeds, then went in and cut the corn, his harvest would be of weeds. If he had a dairy herd from which he continued to sell all the good calves and breed from scrubs, he would wind up with a herd of scrubs. That about describes the processes that have been applied to most forests in the Central States. Now we have a very poor forest of poor species and defective trees. The process by which it got that way is called "overcutting"; that is, men have for years cut more wood than was growing. At the same time they cut the best kinds, so the poorest kinds had room and light to do most of the growing and now occupy too much of the ground.

Also, fire has run uncontrolled for years. It killed out those species that couldn't stand fire, and those that could occupied the ground. Trees left alive were damaged by having fire scars in their bases, and consequently, rotten spots.

Cattle eat hardwood foliage and keep down young growth, the next crop of trees. So, instead of a good procession from seedlings on up to mature trees we have nothing but old, faulty trees on much land.

We want a forest of good species, healthy growing trees, with ages all the way from young to old trees ready to cut. The question is: How can we transform what we have into what we want, and do the job at the lowest possible cost?

If that last stipulation were not important, the task would be much simpler, but it is very important.

We know that our tools will probably be the saw and axe, combined with a great deal of patience. If we could just wait a few hundred years, Nature would doubtless do the job for us, but we need wood and people need jobs. The land must quit loafing and get to work. So we shall cut the material that is now on the ground, but cut in such a way as to move toward the kind of forest we desire. Everything we do must be guided by that motive--to improve the forest.

Here are some of the things we shall need to know:

- (1) What kinds of trees will do best on this ground?
- (2) How many ought there to be to obtain the best growth?
- (3) Since some trees do better in shade than others, how can we manipulate so as to get some shade and some fairly open cover?
- (4) What shall we do to discourage the growth of useless species of trees?
- (5) How can we use the poor stuff now there so as to help pay the cost of improvement?
- (6) What will an acre of this land grow per year after we get a full stand of trees growing?

If we knew all the answers now, we could begin doing a lot of work aimed at making these existing forests more productive. But, we shall learn by doing, because only by actually performing operations on the forest can we find out what the results will be. By cutting in various ways, observing through the years how the remaining trees behave, by measuring the growth, and not being in too big a hurry to just do something, we can find out how to make these hills produce as much wealth as they ought to produce.

The Right Kind of Trees in the Right Place

Generally research is intended to make a product cheaper or better or both and, therefore, to help satisfy human needs to a greater degree. In forestry the product is wood; in the Central States, mostly hardwood.

To grow that wood more cheaply we must find out how to get the most trees of good kinds to grow on forest land. In short, every acre must produce every foot of good lumber that it can produce.

Now, land is highly variable and trees are just like all other crops. They grow best on good land and certain species do better in certain kinds of locations. It is the job of research to find out where commercial species grow best. Since we have to deal with over 40 kinds of trees that yield commercial lumber, and since our lands vary all the way from old fields to virgin forests, and from rich wet bottoms to dry, hot, sandy side hills, the task is a complex one.

Just growing trees is not enough. They must produce good lumber. Short, crooked, knotty trees look all right from a distance and keep the hills green, but they cannot be cut into lumber so anybody can make a profit. If the job of getting the right trees in the right place is done properly, we get the best kind of growth and the best kind of lumber.

The forests we have left in the Central States are not much like the original ones. The best kinds of trees have been cut over and over so that those left are too often of poor species, not very useful. First we must find out what kinds can be grown successfully, and then how to get them established.

How Does Forestry Pay?

As a general social proposition, most of us are pretty well convinced that forestry, its products, the labor opportunities afforded, and recreational and watershed values obtained, all add up to a heavy profit. However, most forestry is and probably will continue to be practiced on privately owned land. If the public is to derive all the above values, private ownership and forestry must be made attractive to the individual. In short, ownership and operation of privately owned forest land must return a profit.

We must know, then, the costs and returns of forestry in order to do two things: (1) Determine and encourage those practices that are profitable; and (2) provide proper bases for determining the relationships between Government and private ownership of forest land.

The determination of the costs of forestry involves:

- (1) Land values.
- (2) Growth and yield of timber and its products.
- (3) Credit mechanisms and their application to forest land.
- (4) Harvesting and milling costs.
- (5) Transportation and marketing costs.

The determination of the returns of forestry involve:

- (1) Returns to ownership by understanding:
 - (a) Markets and their trends
 - (b) New conversion and utilization processes.
 - (c) Improved marketing mechanisms.
 - (d) Values in home consumption.
 - (e) Returns from marketing owner's labor.
- (2) Returns to society in:
 - (a) Labor and capital involved in harvesting, manufacture marketing.
 - (b) Increased tax base in real property and income.
 - (c) Recreational and other esthetic values.
 - (d) Watershed control.

All these things and more combine to make up the Economics of Private Forestry. They are all involved in the economics of Public Forestry but there must be added then the problem of integrating Public Ownership with the maintenance of local governments. Similarly, the operation of publicly owned forests in the public interest involves the integration of such forests with private land in building industries of permanence and maintenance of populations.

These things all require continuous investigations in various economic fields in order that businesses, private and public, may operate intelligently and in the public interest.

Planting Forests

Much of the forester's job in the Central States consists in getting forests reestablished on abandoned farm lands. These lands, once productive, have been robbed, eroded, and left idle. Not only are they not producing; many of them are threats to good bottom land. Planning dictates their use as forests.

The species of trees that constituted the virgin forest will no longer grow on the depleted soil. There is no litter or porous soil to take in water to feed the heavy water requirements of hardwoods. Planting, therefore, to reestablish forest cover and start rebuilding soil, requires the use of conifers or shrubby species that will grow. What to plant on the widely varying sites is a major question which can be solved only by experimentation.

Having determined what species will grow and do well, we must know when and how to plant them. Also, we must know how to grow seedlings in the nursery that will survive and grow in the open field. Sometimes we shall have to fertilize or improve a planting site by other means in order to obtain survival of the trees we plant. Survival alone is the measure of success. The costs, at best, are heavy, so increased survival means less necessity for replanting and money saved.

Finally, we shall have to study our plantations of conifers to see how they can be eventually transformed to hardwood stands either by natural seeding or by underplanting. We shall have to be able to recognize the time when a site is again capable of growing hardwoods.

Growth and Yield

The virgin forest was valuable for the material it had standing in it. The managed forest is valuable for the amount of material that can be harvested on the average every year for all time to come. Its productive capacity is, therefore, measured by the amount of wood it grows per acre per year. That is also the amount we can harvest per year without cutting into our growing stock, after the forest has finally reached the stage of maximum growth.

For a particular kind of land and a particular kind of forest, what is that growth capacity? For most of the land in the Central States, we simply do not know. Hence, we do not know the real basis for sustained yield management, nor do we know the potentialities for profit in growing trees.

In order to calculate the business chances in forestry we must know what volumes of wood will be produced within specified periods of time from lands of varying quality. These facts are almost entirely lacking.

In order to buy and sell logs and trees intelligently, we must know the amount of lumber that can be cut from trees and logs of many sizes and many species. These gaps in our knowledge are very incompletely filled.

Forests and Water

Dry spells seem to affect our streams more than they used to. Lots of springs our fathers knew have long since stopped flowing. We have to drill deeper for water and it does not rise as high in the well as it did years ago. Why? Part of the answer lies in the fact that we have cut and burned most of our forest, plowed and allowed to wash away much top soil from land that should never have been cleared.

Water is one of the products of the forest. The deep litter and porous soil of the hardwood forest takes the water into the ground where it can soak away to lower levels, feed springs, maintain stream flow, and keep water in the wells.

Water that goes into the ground does not cause disastrous floods. We ought to be able to lower flood peaks and have more useful water during dry spells by taking proper measures in managing land. How much are those effects? How much can we be sure of affecting floods or restoring ground water levels by getting good forests back on the land that ought to carry them? If these public benefits do come from forests, how large are they

and how far ought Government to go in executing forestry programs in order to realize them? What kinds of forest cover are most effective in reducing run-off? On our many kinds of soils, what treatments and covers are most effective in preventing erosion?

These are questions that need to be answered to show how forestry can aid in solving the water problems of the Midwest.

Forests and Winds

On the Great Plains men are learning that narrow belts of trees across the direction of the prevailing winds can go far in lessening the terrible effects of those hot, dry winds of summer. Crops grow better in the lee of sheltering groves because the plants evaporate less water in a quiet atmosphere than in a high wind, and water evaporates less rapidly from the soil surface.

Can similar results of value be obtained in the Corn Belt? True, there are almost never crop failures, but many crops are shorter because of hot, dry winds. Could restoration of some of the formerly abundant woods, or the planting of new ones help to make crops more certain, and, incidentally, a more pleasant land in which to dwell?

Many farmers of the Corn Belt are planting new and better windbreaks of trees to break winter's cold blasts. Ought there not be experimentation on better species adapted to the windbreak job?

WHAT CAN BE DONE
TO ENCOURAGE USE OF OHIO-GROWN HARDWOODS 1/

It is interesting to note a shift in emphasis in popular thought from "conservation of hardwood" to "use of hardwood." Yet, the two terms are the same. Conservation involves wise utilization, and we are now in the position of realizing that the greatest single obstacle to good forestry in Ohio is the lack of utilization of the material we are growing.

We know our forests are understocked, and that a high percentage of our standing wood is defective. We know that repeated culling has brought about a preponderance of species of comparatively low value. In order to get back into production of the kind of wood that brings good prices, much of the material now standing must be harvested; but, markets for such material are lacking, returns are low, and stumpage values often negative. Stumpage returns are not high from cross-ties, mine props, car blocking, and fuel wood. Yet those are the products to which the majority of the material now standing in Ohio forests is best adapted. This is in spite of the fact that, potentially, Ohio ranks among the leaders in hardwood lumber production. Perhaps it will be well to examine the hardwood market, the trend of hardwood stumpage prices, and see what has happened to Ohio in relation to these trends.

The earliest figures on hardwood production are in 1869. Figures at this early date are not entirely reliable, but they indicate that Ohio was at that time producing 14 percent of the total hardwood lumber cut, or 488,000,000 board feet. A good measure of utilization is per capita hardwood consumption. In 1869, this nation consumed 94 board feet of hardwood per capita per annum. By 1899, thirty years later, Ohio reached its peak and produced 951,000,000 board feet of hardwood, or 10.7 percent of the total. By this time, per capita consumption of hardwood had reached 116 board feet per capita per annum. Per capita consumption reached a peak in 1906, at 126 board feet. However, by this time Ohio had long since passed its peak of hardwood production, and was now down to 433,000,000 board feet per annum.

Per capita consumption of hardwood trends increasingly downward from 1906. The biggest break came between 1906 and 1913, during which years consumption dropped from 126 board feet to 97 board feet. This period coincides with the biggest drop in total lumber consumption. Various explanations have been given for this phenomena; there appear to be two principal factors involved. First, the period coincides with the completion of the major portion of farm construction in the United States. Second, there began a period of centralization of population in urban districts, where frame construction was not permissible. Whatever the explanation, hardwood consumption continued to decline up to 1929, in spite of increasing prosperity in the country. By 1929 consumption stood at 51 board feet per capita per annum. It may be considered that the last ten years have been abnormal. Certainly lumber consumption has been at a low ebb. During these years any time there has been an upturn in the residence construction curve, the curve for lumber consumption has followed it closely. During the past few years, hardwood lumber consumption has averaged in the neighborhood of 20 board feet per capita per annum.

1/ Paper read by J. Alfred Hall before the Ohio Forestry Association, February 1, 1940.

Ohio's production of hardwood lumber has progressively decreased. From 433,000,000 in 1906, production became fairly well stabilized at in the neighborhood of 185,000,000 or 190,000,000 up to 1929. In 1932 it reached an all-time low at 32,000,000. Figures for 1934, the last available, show a production of 82,000,000 board feet of lumber. It will be understood that these figures are exclusive of cross-ties and other materials cut from hardwood land.

From the above figures, the following conclusions may be drawn: Ohio had passed its peak in lumber production before the peak of hardwood consumption had been reached. While hardwood consumption remained almost static from 1919 to 1929, Ohio's production dropped from 280,000,000 feet to 175,000,000 feet.

A brief analysis of hardwood stumpage prices during the past generation or two might well give some relationship that would indicate whether or not hardwood production in Ohio was keeping pace with hardwood market trends. No one can predict in advance the trend of stumpage prices. However, the record of past stumpage prices, and of their relative stability, as compared with prices of other basic raw materials, is the best indication of the relative position of future stumpage prices. From such an analysis we may be able to draw some conclusions as to whether future forestry in Ohio may pay its way. It is perfectly true that, throughout the country at large, there is no such thing as a true stumpage market. Nor will there ever be a true stumpage market as long as large bodies of distressed virgin timber remain on the market. However, in the East, in the South, and in the Central States, distance from market of virgin timber has had no little effect in determining standard stumpage values. In these regions, then, stumpage prices may be considered to indicate rather well the stable trend of values.

Stumpage prices of hardwoods adjusted to the varying value of the dollar show the following from 1900 to 1934: In 1900, hardwoods were selling at an adjusted value of about \$1.65 per thousand. The trend has been generally upward until in 1933 they reached a value of \$5.34 per thousand. There have been minor variations in the curve, but the general upward trend is pronounced. By contrast, the adjusted price of stumpage in softwoods has increased from \$.95 in 1900 to only \$2.43 in 1934. A study of these figures clearly indicates that, although actual average stumpage prices in the country as a whole have declined since the late 1920's, the real price in terms of the purchasing power of the dollar has not only been maintained, but has shown a distinct increase for the period 1920 to 1934.

So much for the nation-wide picture. Now let us look for a moment at the picture in relationship to the price of stumpage in the Central Region, from 1900 to 1934. In 1900, the adjusted price of stumpage for hardwoods was \$5.29 per thousand. The variation has been broader than in the over-all price figures. An all-time low was reached in 1918, at \$1.44 per thousand. An all-time high was reached in 1923, at \$7.04 per thousand. In 1934 the price stood at \$4.69, or sixty cents less than in 1900. In short, in the face of a general and continued regular rise in hardwood stumpage prices, there has been an actual average decrease in hardwood stumpage prices in the Central Region.

By contrast, let us consider hardwood stumpage prices in the Southern Region from 1900 to 1934. Actually, the earliest quoted values appear in 1903, when the hardwood stumpage price was \$1.15 per thousand. The upward trend in this region has been more marked than the general trend throughout the country. The price in 1934 was \$4.80.

The South is constantly becoming a more important source of hardwood lumber and other hardwood forest products, in spite of the fact that, in general, southern hardwoods are not of equal quality to those normally produced in the Central Region. In 1900, 18 percent of the ash lumber produced in the United States came from the Southern Region. In 1933, the South furnished 56 percent of the total quantity of ash lumber. The percent of hickory lumber produced in the South increased from 10 percent in 1900 to 52 percent in 1933, while that of oak increased from 12 to 52 percent.

There are a few other significant things that ought to go into the record. Stumpage prices did not go back to the pre-war level during the depression years. They have been maintained at levels appreciably higher than the all-commodity index since 1921. Log prices did not go as high during the years of inflation, nor as low during the years of the depression, as did the average price of farm products. Log prices on the average did not descent to the pre-war level during the depression, while the average price of all farm products was below the 1910 to 1914 average in 1931 to 1934. It is also interesting to note that hardwood log prices have been maintained by and large at higher prices since 1920 than have softwood log prices. 1/

We may draw the following conclusions from the quoted figures:

(1) There is a large and continuing hardwood lumber market in the United States. It is smaller than in former years, but it is still a good market. (2) Stumpage prices and log prices indicate that the Central Region is no longer obtaining a proportionate share of that market. The major portion of the market has moved to the South. (3) General stumpage figures indicate that the public demand for good quality hardwood continues. This is indicated by the fact that stumpage and lumber prices have shown consistent upward trends during the past forty years. We may logically ask the question, therefore, "If there is a market for hardwood materials, why are we unable to dispose of the hardwoods now being produced on Ohio land?"

The uses to which hardwoods are put are widely different from those to which the softwoods are adapted. Hardwood uses depend upon strength properties, beauty of grain, adaptability to high finish, and certain other characteristics that render them specialty products. For example, hickory is not much used as a construction material, but finds its widest usefulness in those places where its properties of high strength, stiffness, hardness and shock-resistance make it desirable. It is therefore used for handles, shafts, poles, spokes, rims, and in gymnasium apparatus and similar places. Ash has similar uses, but is also adapted to agricultural implements and various other places where shock-resistance and stiffness are desirable properties. Black locust, the heaviest and hardest of our native woods, is low in shrinkage and very durable. However, it has very small use in construction, and finds its principal utilization as insulator pins, tree nails, wagon hubs, or in the more lowly uses of fence posts,

1/These data are taken from Technical Bulletin No. 626, July 1933, by Henry B. Steer, "Stumpage Prices of Privately Owned Timber in the U. S."

mine timbers and poles. Our oaks, the white oaks especially, are heavy, hard, stiff and strong. They find their usefulness in flooring, in interior trim, in furniture manufacturing, implements, cooperage, piling, cross-ties, and timber. Actually, the only hardwood that has found any wide useage as a structural material has been yellow poplar. It has been almost entirely displaced in this field, however, by the softwoods, and poplar now finds most usefulness in interior finish, siding, furniture, and other products that are to be painted and enameled. It is also widely used in the manufacture of veneer, panels, and the lower grades for boxes and crates. Almost without exception, the uses of hardwood thus far have demanded clear material, free from knots, free from defect; in general, high-grade material in contra-distinction to many uses that have been found for low-grade softwoods. Inferior hardwoods not only do not demand good stumpage prices for lumber conversion, but in general are not salable at all except for uses that command very low, if any, stumpage values. The answer, then, to the trend of hardwood stumpage prices in the central west, and perhaps the answer to the fact that consumption of central hardwoods is at a low ebb, may be found in the fact that Ohio lands, as well as other central region lands, are no longer stocked with material suited for those uses upon which the continued market for hardwoods has been based.

In short, where the oak market is for clear lumber, free from rot, free from knots, we know that our oak stands are now so defective that it is almost impossible to find a tree that cuts out even a small proportion of the select grades. Grade analysis in general for hardwood production in the Central States shows a steady drop in quality during the last twenty-five years. The furniture industry, finding no material within easy reach of existing plants, has continued to go into the South and import material in order to continue operation. The hardwood industry suffered a heavy blow when the automobile industry shifted from hardwood bodies to all-steel bodies. This had nothing to do with the availability of hardwood; it was simply a case of an industry developing to the place where one material became more suitable for its use than another. However, it must be admitted that the hardwood industry in general has not kept pace with industrial developments in other fields. Where the steel industry has continued to adapt its material to uses and fabricate shapes and sizes to the order of the assembler of implements or tools, it has been increasingly difficult to obtain prefabricated hardwood materials for special uses in assembling. For example, a case recently came to light in which a refrigerator manufacturer had been swinging his motor and compressor unit on a hardwood panel near the bottom of his refrigerator. He found it extremely difficult, if not impossible, to get a hardwood premanufactured panel, bored and fitted to a template so that he could buy it ready to install. However, when he went to the steel manufacturer, he found it easy to get a steel shape bored and stamped. All he had to do was to install it. The point is that, although hardwoods can be manufactured to the requirements of the assembly plant, they have not been so manufactured, and much market has been lost to competing materials.

Among our oaks the principal volume consumption in former years was undoubtedly in the form of flooring and interior trim. In recent years it is perfectly evident that fashion has dictated interior trim in other than hardwood finish. Most houses these days have softwood trim, and paint or enamel finish. This has undoubtedly played a large part in

the decrease in oak consumption. There was a certain recovery in oak with the return of liquor and the demand for tight cooperage. This is a continuing demand. In the slack cooperage market, elm still occupies an important field. In the field of boxes and crates there have been large inroads by fiber-board boxes, which ~~have~~ continually displaced large volumes of hardwood and softwood formerly used in this field. The maple market probably continues to absorb more clear maple in the form of floorings than in any other form, although large volumes also go into furniture as is the case with oak. The furniture field undoubtedly is still an excellent market for hardwood.

To sum it all up, the fact is that there is a continuing fair market for hardwood lumber, but this market demands qualities that are not now being produced in the central hardwood region. Yet, we must sell the hardwood that we have on the ground before we can begin to grow the qualities demanded by the market. Our central question, then, is how to promote the utilization of the material available so that we can get back into the production of material that will command a real price on the stumpage market.

There are a few trends of favorable nature that ought to be discussed. One of the most interesting ones is the trend in certain sections toward the use of hardwood in local or farm construction. I have recently seen some excellent barns constructed in Indiana from local grown hardwood lumber. When properly cut and properly seasoned, and properly used, these materials can be constructed into serviceable barns. One farmer of my acquaintance insists that in his lumber bill for the construction of an average-sized dairy barn on his place he saved just \$1100.00 in lumber cost alone. As a matter of fact, he grew the lumber on his own place. Requirements of lumber for farm construction are less rigid than those for the furniture, interior trim, or other specialty markets. The local producer starts with an advantage of somewhere in the neighborhood of \$15.00 a thousand in transportation cost assessed against softwood brought in from the West Coast. In Indiana, county agents in certain districts are encouraging use of locally sawed lumber in such farm and local construction. It would appear that a similar procedure in Ohio might bring some results.

There is another important trend in the hardwood industry that offers some hope in utilization of comparatively low-grade material. I refer to the so-called "dimension stock industry." All shapes and sizes cut from various species of hardwood are widely used in furniture manufacture, and in various other places where large sizes are not required. There has been an increasing tendency among manufacturers in recent years to avoid, if possible, the operation of a sawmill or a cut-up plant for the production of the stock item used in assembling. Instead, they have preferred to buy materials cut to approximate size and shape. In their own plant, they finish the shape to the required size and form, and incorporate it in the article for which they are prepared to complete the manufacture. This has led to the establishment of cut-up plants in various localities that buy rough lumber, season it, and cut it to small dimensions suitable for delivery to assembly manufacturers. In some cases it has already become apparent that such a procedure offers opportunities for the utilization of

comparatively defective logs that have hitherto been considered not worth the cost of cutting into lumber. Instead of discarding such material, it now becomes possible to cut between the knots and between the rotten spots, and recover the clear material that is of sufficient quality and sufficient size to manufacture the small-dimension pieces used by the furniture manufacturers. As a matter of fact, there is also a considerable industry in the manufacture of hardwood flooring in random lengths, which is also cut from similar defective material. This market is a rapidly expanding one, and offers real opportunity in utilization of low-grade trees. It is not going to bring about miraculous stumpage prices for fire-scarred and decayed material, but it will make possible the realization of at least the cost of removal of the material from the ground.

There have recently been developed also new techniques in the utilization of small pieces of hardwood cut from larger defective boards. That offers some promise in the building field. So far, hardwoods have offered little competition with softwoods in the field of siding or weatherboarding, drop-siding, or even in the field of the formation of inside walls. The only exception has been in cases where somebody wanted to spend a good deal of money in getting a hardwood paneled interior. These have been expensive because large pieces of clear material were required. Recent developments have shown the possibility of combining small pieces of hardwood, glued together in panels that fit in between the studs, and forming a comparatively inexpensive hardwood paneled interior. Similar developments are taking place in the possible utilization of small pieces of hardwood in the formation of exterior walls.

There is one thing in common between all these processes: They require comparatively low-grade logs, but they do require cut-up plants and dry-kiln equipment of high standards. This brings us to the general problem of the lack of well-developed harvesting and marketing facilities for our hardwood material in Ohio. In general, we deal mostly with very small and very inefficient mills that are equipped only for the production of rough and unseasoned lumber. Such material, poorly graded, poorly manufactured, and of general poor quality throughout, can command only comparatively low prices in the market. The hardwood that finds its way into the retail lumber yard as kiln-dried and well-manufactured material commands very high prices. Also, comparatively little of it now comes from the central hardwood region. The facilities required for the manufacture of such material are not available to the small sawmill operator. If, however, numerous small sawmill operators could be combined into cooperative arrangements with a central cut-up plant equipped with proper kiln-drying facilities, it seems entirely possible that these new markets for dimension stock might be supplied from material now capable of being harvested within the confines of Ohio. It does not seem probable that these demands will be met from material now being harvested and marketed in the haphazard way obtaining. The low prices for such materials as mine timbers, cross-ties, car blocking and the like can only be replaced by the potential high prices obtainable for clear sawn material properly manufactured and properly kiln-dried, if there is an extensive revision of haphazard marketing arrangements. As long as the present marketing and manufacturing arrangements continue, farmers will continue block sales of hardwood timber. Such sales lead to exploitive cutting and abuse in manufacture, and to continued degradation of the market.

There are one or two other hopeful features in present technical developments that ought to be described. In the first place, hardwoods in the middle west have not enjoyed very much demand in pulp manufacture. The reason has been principally the very large supplies of coniferous woods available, and the better adaptability of coniferous woods to those pulping processes most widely used. I may say confidently that pulping processes are in process of development that are much less critical of wood qualities than have been the older processes. Whether or not they will bring about expensive conversion of hardwoods into pulp I cannot say. It would seem, however, that there is hope of more extensive utilization of low-grade hardwood materials than has been the case in the past. If this comes about, the sort of material that we now have on Ohio lands would be available for pulp use. It would not command high stumpage values, but it could be removed from the ground at perhaps an even break between cost and return. If we could even accomplish this, we would have made a long stride toward good forest practice in Ohio.

There is another potential development in the offing that offers some promise. I refer to a process, quite different from the old steam bending processes, that makes wood a material capable of being shaped into almost any desirable form without sacrificing its beauty of grain and structure that has made it a very desirable material for furniture. Such a development would undoubtedly insure wood for a long time to come pre-eminence in the furniture field.

In the case of the utilization of wood waste, recent developments have shown it possible to produce an excellent plastic by hydrolysis of such waste. This plastic, in powder form ready for molding, costs only about one-fifth the price of normal phenol-formaldehyde resins or analagous products. The product has the disadvantage of being made only in dense black form. However, its strength values, resistance to moisture, and fire-proof qualities indicate a wide field of usefulness. Obviously, only wood waste is suitable for manufacture in such a product. It is entirely possible that low-grade materials, such as can be harvested from much of our land, will also find their widest usefulness in conversion into some such product. To sum up, we need to encourage better manufacture and better marketing of the material that we now produce. Second, we need to encourage the development of dimension-stock manufacture within our State in order to utilize the clear wood that can be obtained between the knots and rotten places within our trunks. In the third place, we need to encourage the development of the use of local-grown lumber for local and farm construction needs. In general, if we are to regain our former position as an important producer of hardwoods, we must convert the present decadent and inferior stands into stands of clear, sound trees. This can only be done by removing, sometimes at a loss, the defective material now encumbering the ground. It is idle to speculate on the possibility of large returns from such material. The hardwood market as it now exists demands mostly clear material, soundly manufactured, and soundly marketed. Ohio has not been keeping up with the procession in that field. In spite of the natural productivity of its forest lands, it has allowed them to become encumbered with inferior material for which there is no real present market that will give good stumpage returns. It will take time, perhaps the investment of considerable money, and a lot of patience before Ohio becomes again a major producer of high-grade hardwood lumber.

AN EFFECTIVE FORESTRY PROGRAM FOR OHIO ^{1/}

An effective forestry program for Ohio must be a program that looks far into the future. It must be a program fitted to the land, to the needs of the times insofar as we can foresee them, and to the people who will come after us. At the same time it must be so designed that it will not place an intolerable burden of investment upon those who now pay taxes and, if possible, should operate in some measure so as to relieve unemployment and distress. Therefore, tonight I am not going to dwell upon the happenings of the past, but shall attempt to project our thoughts into the future, to see what social benefits and rewards we may expect from the constructive forestry program that is now submitted to the people of the State of Ohio. The past is of value only insofar as we can learn to avoid its errors, and to profit by its successes.

I suppose no evil is always unmixed with blessings. It may be difficult at this close range for us to recognize any benefit that may have flowed from the past ten years of economic stress. However, I believe no one will deny that this disastrous experience has taught us many things that we sadly needed to know, has taught us to question many of the beliefs that we accepted in the past. It has taught us to view the future more as a time of settled economy in which men can plan to live steady and thrifty lives, than a time in which rapid development, wild speculation, and unheard of profits may again arise. We have learned among other things that our land is sick; we have learned that even in the great and rich State of Ohio nearly 25 percent of the land area is producing very little and in large parts nothing of any social value. We have learned that in agriculture or in industry too much specialization may not pay. We have learned that heavy industrial developments do not insure the continued prosperity of a community or a city. We have perhaps learned that all things that are new are not necessarily better than all things that are old.

There was, and perhaps still is, a school of thought that tries to teach us that eventually, through the development of ultra-scientific processes, we shall be liberated from our dependence upon the land and its products. The writers for Sunday supplements take great delight in portraying for us a world of the future in which everybody lives in glass houses, eats capsules, works one hour a day, and spends the rest of the time in fruitful higher pursuits. A realistic point of view would seem to indicate that, until there is more present evidence of the advent of such an era, it would be well to safeguard the land and learn to use its products. As an example of the neo-modernistic school of thought, and because it is of particular interest to us here tonight, we might look for a moment at the oft repeated statement that wood is to be replaced by newer, more wonderful and far superior materials.

Part of the trouble with our thinking about wood has arisen from false ideas concerning the Nation's wood requirements, founded upon the history of earlier years when we were a young and building Nation. It is perfectly true that wood consumption in the United States reached a peak about 1910 and has been steadily declining since. It is also true that, during the past 20 years, the use of other materials than wood for

^{1/} Talk given by J. Alfred Hall before Ohio Forestry Association, January 30, 1941, at Pomerene Hall, Ohio State University, Columbus, Ohio.

construction and other purposes has increased. It is not true, however, that wood is fighting a losing battle against superior substitute materials. In the first place, the perfectly enormous consumption of lumber in the latter part of the nineteenth and the early part of the twentieth centuries was due in no small measure to the fact that we were still constructing houses and barns both in towns and on the farm. Along about that time, as you may recall, the settlement of agricultural land came almost to an abrupt end. If we examine farm properties throughout the Middle West today we can almost date the structures of most of them as preceding that date.

I said that the consumption of wood and wood products had steadily declined since 1910. That is not strictly true; the consumption of lumber reached a low point about 1932 and 1933. Since that time, with only a few interruptions, it has steadily ascended. Last year, a year in which residential construction did not by any means reach the level of necessary replacement, the American Nation used approximately 200 board feet of lumber per capita. In the two or three years preceding they had used between 165 and 180 board feet per capita per year. I speak only of lumber. In other products, namely, cross ties, fuel wood, posts, piling, paper, and a myriad other forms in which wood is utilized, we withdrew for use from our forests about the same amount. In all, therefore, we are now using approximately the equivalent of 400 board feet of lumber per capita per annum. Visualize that for a moment; that would be a board an inch thick, a foot wide, and 400 feet long that each of us was responsible for consuming in a year. I do not believe that a very large proportion of the American public have any real idea of that enormous wood consumption. The average business man, for example, occupying an office in a steel and concrete skyscraper, driving an all-steel automobile, and traveling in an all-steel Pullman, may think that he is out of touch with wood and that wood no longer enters into his own personal economy. Some of you heard Dr. Dana the night before last narrate the daily life of a typical American male. Because it well illustrates the point, I am going to repeat, if I may and if I can, the story that Dr. Dana told. It goes about as follows:

We see John Jones, typical American male, peacefully slumbering in a wooden bedstead. Because he likes the feel of it he is wearing rayon pajamas. Rayon was made from pine cellulose. His alarm clock sitting on a wooden bed stand goes off promptly. John Jones stretches, yawns, and emerges from the bed onto a hardwood floor. His shaving materials are contained in a wooden cabinet. His mirror has a wooden frame. He goes back to his dressing room and removes a clean shirt from the top drawer of a wooden chest of drawers, dresses himself and dons a necktie half of rayon made from wood. Having dressed, he walks on a wooden floor to a wooden stairway, descends, resting his hand on a wooden stair rail, crosses hardwood floors to the breakfast room, where he sits on a wooden chair, eats from a wooden table, and props against the coffee pot a newspaper made from wood pulp. Even the ink that was used to print the newspaper contains rosin from the southern pine. Having settled himself comfortably he proceeds to eat a breakfast food which some of us might think was made from chips or sawdust. Breakfast finished, he dons his hat and coat, rushes through a wooden door to the garage, opens his wooden garage doors, backs out the car, and whirls out of the driveway, just missing the wooden telephone pole at the corner, which also carries the electric light wires

that service his home. Arriving at the office he may walk on a linoleum floor made from cork, ground wood, rosin and linseed oil, to his wooden desk, where he wearily drops himself into a wooden chair for the beginning of the daily grind.

Having reached into a wooden desk tray for his morning mail, most of it written on wood pulp paper, and having digested it rapidly, he calls his stenographer and proceeds to dictate to her. She uses a wooden pencil to inscribe pothooks on woodpulp paper, and both of them undoubtedly suspect the other of having a wooden head. At noon, after lunch, he joins a friend and they proceed to bowl on wooden alleys against wooden pins. Or they may play billiards on wooden tables with wooden cues. After work in the afternoon he plays around of golf with a wooden club and wooden tees. Returning home, he drops into the kitchen, finds his wife preparing biscuits in a wooden mixing bowl with a wooden spoon, and if he perchance might be a little late he will indeed be lucky if he is not met with a wooden rolling pin. She perchance may need a check which he proceeds to write with a fountain pen the case of which might well be cellulose acetate made from wood. The paper itself will undoubtedly contain wood pulp although the check might perhaps be rubber. He sits at a wooden desk and uses a blotter made of wood pulp. After dinner he enjoys the evening paper made of wood in front of a glowing wood fire which casts soft lights and gentle shadows over the finely polished surfaces of the wooden living room furniture; an evening of bridge perhaps, sitting on wooden chairs around a wooden table, with crackers and cheese later in the evening served on a wooden tray. And so, finally, back to his wooden bed, tired and comfortable, to sleep till morning like the proverbial log of wood.

This simple little narrative has no plot, I confess, merely gives a partial exemplification of the manner in which wood touches every angle of our daily life. It is such a familiar thing, such a useful thing, such an old thing, that we have lost, in large part, our regard for its real value. We have thought that because wood was old its use could not be as satisfactory as the new materials; and yet, through it all wood has continued to play its part and seems to be actually increasing in importance. Did you know, for example, that during the past 50 years 2,500 patents have been issued for materials supposed to be superior for railroad ties, and yet today not one of them is in any important use? The heavy steel trains of the Nation continue to be carried on wooden cross ties because no other material has ever been found that could be used in the American track to give us smooth and satisfactory transportation. The communication and electric lines of the Nation are still carried on wooden poles. The steel skyscrapers of many of our cities rest upon wooden piles sunk into the yielding sand. The mine props that make possible the winning of our coal and many other minerals are made of wood. The forms without which many of our concrete structures could not be built are mostly wood. These are mostly old uses and continuing uses. Is there anyone among us so wise he can predict that all these important uses of wood will fade within the next generation or two, and that we shall have this miraculous economy in which we can live well without wood?

We have worried about markets for hardwoods in Ohio. Last year, before this audience, a paper of mine was read in which I made the statement that I believed that if and when Ohio returned to the production of good hardwood there would be found ready and waiting a good market. I did not know at that time just how diversified wood manufactures were in Ohio. Since that time I have been able to consult a directory of manufacturers in Ohio issued by your Department of Industrial Relations in 1939. I give you here a list of manufactures in Ohio in which I know wood or its products are used. I have left out many manufactures in which I could not tell, from the directory, the material from which the articles in question were manufactured.

- Agricultural implements
- Air registers made of wood
- Paper bags
- Bakelite and other molded goods, most of which carry wood flour as a filler
- Baskets of wood and willow.
- Billiard tables
- Blackboards, the frames and backing of which are mostly of wood
- Cigar boxes
- Fancy and paper boxes
- Drinking cups, and mailing tubes
- Boxes and packing crates
- Brooms and mops, and brushes
- Chemicals from wood distillation
- Coffins
- Cooperage and related goods
- Dairymen's, poulterers' and apiarists' supplies
- Furniture
- House furnishing goods
- Mirror and picture frames and moldings
- Models and patterns
- Saw handles
- Sewing machine cases
- Ships and bolts
- Show cases and store fixtures
- Prizes and games
- Wood-bending, turning and carving manufactures
- Woodenware manufactures
- Wood preserving plants

These are only a few of the secondary manufacturing industries that depend upon wood; and you have them already in Ohio.

I then went ahead and made a rough analysis of the number of people in the State that were employed in saw and planing mills. The figure, as of 1939, came out about 6,000. I found that about 7,800 people were employed in the State of Ohio in the furniture industry. I found also that the major portion of the wood requirements of the furniture industry now come from outside of the State. I have no way of estimating the number of people actually employed in all of the industries I mentioned a moment ago that use wood in some form in manufacture. However, in a neighboring State fairly accurate figures have been determined for the

amount of labor that goes into hardwood manufacture. That is, if we take hardwood timber and determine the amount of labor that goes into it from the time it is cut off the stump until it gets into the consumers' hands, we find that, on the average, it takes about a man month of labor per thousand feet of raw lumber. This figure varies tremendously from quite a lot lower to nearly double the above figure. However, the rough figure of a man month per thousand feet of crude lumber seems to be a fairly accurate measure of the importance of hardwood in manufacture. On this basis I calculated what the employment base might be that was furnished by the present cut in this State of approximately 100,000,000 board feet of lumber per year. That came out to be 8,333 man years. Now as a matter of fact, that 8,333 is not far above the 7,857 employees that are listed in the furniture industry. However, you will recall the rather imposing list of wood manufactures that I gave to you, and that is really only a fraction of all the industries that use wood or its products in some form. It is perfectly clear, therefore, that the actual wood produced in the State, when translated into terms of employment base, is far short of the total number of man years actually working with wood. When we consider that, of this 100,000,000 board feet to which I referred, a large proportion is actually rough lumber and never goes into manufacture, the discrepancy becomes much greater. Therefore, one can make the statement, I believe, with some degree of assurance that the actual hardwood demands in Ohio are now far in excess of the available supply. We know that is true without any figures, for if it were not true the hardwood-using industries of the State would not be importing a very high percentage of hardwood from other States. As a matter of fact, I was in a neighboring State the other day, one that produces no better timber than that which Ohio ought to produce in large quantities. I was visiting a small mill, one employing not over a half-dozen men, and what do you suppose they were cutting? They were cutting oak dimension stock for chair manufacture. By dimension stock for chair manufacture I mean material cut to approximate size and design for further shaping in the final manufacturing plant. The stock being cut in this little mill was for an order from a city in Ohio.

I tried to calculate then what Ohio ought to produce, and I came to the conclusion that on a very conservative basis of growth and yield Ohio ought to produce somewhere in the neighborhood of 500,000,000 board feet of lumber per year, and that this ought to be hardwood. There is no reason why Ohio should buy hardwood from anybody. She should produce her own requirements in use and manufacture and be able to trade hardwood for the softwoods she needs, in construction especially. On the same basis as I calculated above, that half-billion board feet of lumber ought to employ 40,000 people the year round. If we give each man four dependents, that means a total population of 200,000. If we accept a conventional figure to represent those engaged in distribution and services to those engaged in primary manufacturing and extraction industries, we ought to put about four people again into the picture. In all, then, we shall find that a wood production of that magnitude ought to furnish an economic base for a population of nearly a million people. I do not believe such a figure is fantastic. I have found in other States too many excellent examples of populations living upon a forest base to make me doubt the possibility of the same sort of an economy in much of Ohio. For example, I know a county not very far from Ohio in which over half of

the urban population, about 5,000 to be exact, works all the time in wood-working industry. I know a town with a population of 6,000 in which nine-tenths of the people who are gainfully employed outside of distributing and servicing industries work in wood manufacture. These two particular instances I am citing are from very poor counties if measured by Corn Belt standards. Yet these populations are fairly prosperous and have remained so during most of the depression.

I wanted to see what was the distribution of the wood-manufacturing industry in the State. Therefore, I examined the record for fourteen counties in southern Ohio and found that in these fourteen counties there were actually only 59 industries that were primarily dependent upon wood. Of these, two were cooperage plants, five were furniture factories and 52 were saw and planing mills. These 59 industries employed 758 people, but that does not give a true picture. Two of the furniture factories, fairly large, employed 212 people, which left 546 to be employed by 57 industries, or less than an average of 10 per industry. Now the reason I was interested in making this little analysis was because of the fact that one of the first things that struck me about Ohio was the lack of wood-manufacturing industries in those sections of the country in which wood should be the principal crop, namely, the hill counties of the south and east parts of the State. I think you are as well aware of the history of those counties, and perhaps much better aware, than am I. However, this must be said: It seems to be true that even from the beginning the presence of iron and coal had a great deal more to do with the development of the typical economy in the hill country of Ohio than did any other single factor. The iron industry, together with the ceramic industries, gave a fair prosperity to those sections for many years. What happened to the forest? I was interested the other day to read an old account of the tremendous importance attached in southern Ohio to the advent of the hot-blast iron furnace which reduced the consumption of charcoal per ton of iron almost 20 percent. I wondered what might have happened to the unfortunate forests of southern Ohio had the iron industry not been extinguished by the advent of cheaper ores. Be that as it may; the underlying cause for the lack of development of wood-using industries in southern Ohio seems to me to have been this overwhelming importance attached to those industries dependent upon the extraction of materials from beneath the surface. Wood was only a means toward the production of iron. The living and renewable forest seems rarely to ever have entered the consciousness of the resident population as a possible important resource upon which a permanent economy might have been reared.

And so came the 1930's, when the industrial machine almost ran down, when the coal industry was no longer capable of absorbing the labor supply, when construction fell to so low an ebb that the ceramic industries suffered, and there was little forest base left in southern and eastern Ohio. Then we had distress, and you heard Tuesday night that in 15 counties in southern Ohio thirteen million dollars were spent for relief in 1939. We must ask ourselves if it is possible to rebuild an economic base under the people of these counties less bountifully endowed with good agricultural land than are those of the Corn Belt proper. I believe it is possible to do so. However, candor compels us to face some hard facts. A ruin that has been made in 100 years cannot be repaired by lip service nor by puny investments over a short period of years. It will take much time, much patience and, I fear, much money.

The figure that I used to arrive at my estimate of the total wood-producing capacity of the State of Ohio was based upon an average growth of 100 board feet per acre per year. I am sure that much of our land already exceeds that, but most of it falls far, far below it. I am confident that in the hill country most of our land can equal or exceed that rough average figure. On that basis I am equally sure that within 50 years of protection and proper management we shall see a real timber harvest beginning in our hill country, and unless a future generation repeats the mistakes of the past there is no reason why this harvest should not continue indefinitely into the far distant future. If we base our thinking about future returns from forestry in these poor hill counties only on the returns to land ownership itself, we shall get but a very inadequate picture of the social and economic results. I tried to point out above that when we are growing hardwood on these hill lands we are actually growing opportunities for labor. The yield itself, translated into terms of stumpage value with which foresters love to deal but which are hopelessly inadequate, this 100 board feet might not represent more than \$2 per acre per year. It is perfectly obvious, therefore, that forestry as a form of land management to return adequate living from the sale of crude products to all the resident population of the hill counties falls far short of the mark. If we are to carry through and reap the rewards of what I hope will be a wise investment in forestry, we must arrange for the development of a wood-minded economy of manufacture in the hill counties. Industrialization on that basis means the development of an economy that will depend only upon the productive capacity of the land itself, which under good protection and good management need never again be impaired. As a matter of fact there is no reason why, for another 200 years, the growth capacity of most of the land of southern Ohio should not increase. Industrialization on a wood base, if the experience of the past is any criterion of what will come in the future, should fit into the needs of the Nation for all years to come.

I tried to point out a little earlier that in my estimation wood was destined to remain as an important article of consumption in some form or other for many years to come if not forever. It is indeed a material of many uses and many adaptabilities. We often fail to recognize it in even its present-day form, and yet the wood use of the future bids fair to take even more varied forms than those in which we find it today. Let me recite just a few new developments.

I have here an ashtray, hard, dense, black. It is made of hydrolyzed wood, ground wood hydrolyzed with acid under a pressure, and then pressed back into this form after certain simple chemical treatments. The other day I saw a piece of wood that was twisted and bent in every conceivable shape and form. And yet it was hard and dense and strong. We have recently learned how to make wood itself a plastic easily worked while hot, and sturdy and stable when cool. In the last two years we have learned to impregnate wood with some of the new resins, apply heat and pressure, and compress it into a form that is enormously strong. When many laminations of this compressed wood are joined together by use of some of the new synthetic resins we get a material that is so dense and hard that it approaches steel in its properties without losing the desirable properties of wood. This material is now being used in the manufacture of airplane propellers and other uses where great tensile strength is required.

Most of you are familiar with veneer in the form of furniture. Some of you are familiar with the developing uses of plywood. How many of you, though, are aware that the newest developments in airplane manufacture utilize plywood for wings and fuselage, plywood joined with the new water-proof phenolresin cements. During the first World War we used tremendous quantities of Sitka spruce in the manufacture of airplanes. Then we developed the all-metal plane in the hope that we could avoid the use of wood. And now England and America both are swinging back toward the use of wood in the combat plane and the training plane. Just what the developments in this field may turn out to be I cannot say, but it is perfectly evident that the engineering profession is again beginning to look upon wood as an essential material.

I could go on and narrate numerous new adventures in the technology of wood use, but I hope I have said enough to indicate to you that this oldest of all engineering materials is in many of its aspects also the newest. For many years it might have been said with justice that wood was perhaps the poorest known of the engineering materials. This is no longer true, and as we learn more about it we learn more ways in which it can give adequate satisfaction in use.

Therefore, all the things that I know teach me that in the economy of the future when the things that come from beneath the surface of the ground shall have become increasingly scarce, we shall become more and more dependent upon this universally serviceable material, wood. Can a State or a Nation afford to gamble with the future supply of a material that has demonstrated throughout the ages its essential importance to civilization? Yes, we can live without wood; but I am sure that we cannot live as well. I am equally sure that as long as wood remains plentiful and cheap there will always be a market for good quality material.

To the farmer of the Corn Belt the woods has not always been regarded as an asset. There are a sufficient number of outstanding examples, however, of well managed woodlots on prosperous farms in the Corn Belt to warrant our statement flatly that good farming and good woods management in the Corn Belt go hand-in-hand. Those men who know and love the land and its products are usually those who are good farm managers. Good farm managers have never failed to recognize that, where possible, sound economic organization on the farm dictated the production of all materials economically possible for consumption on the farm itself. Wood has been no exception. The farmer uses on the average in the Corn Belt 1,500 board feet of lumber per year. In addition he uses enormous quantities of posts and, in many localities, enormous quantities of wood for fuel. There is no question that, in conducting a farm business where there are lands that can and ought to be in trees, a sound economic organization would dictate they be in trees and managed for continuous wood production. I would not argue that land in the Corn Belt, highly developed, expensively drained, suitable for high level crop production ought to ever go into trees; but there are many, many farms in the Corn Belt that do not consist of such kind of land. On most of them there are ample acres to support an excellent woods. It is up to the farmer himself to see that those woods produce the materials that he needs to run his own business.

As I have tried to point out, the situation in the hill countries is entirely different. There the only real base of life must be the forest with the attendant fullest development of the agricultural land that is possible. I foresee, therefore, in the hill counties, a combined economy of forestry, forest products manufacture, and subsistence agriculture on the limited agricultural land. To bring these things about, as I indicated a moment ago, will take time, many years and much money. There is no need to shirk the facts. Unless public investment, ample, well administered, wisely handled, starts to rebuild the economic base in the hill counties, there are only two alternatives: (1) the removal of a large part of the population to other localities where an economic base does exist; or (2) the continuous maintenance of a huge relief burden. I firmly believe that the wise investment of a part of the present relief money in the hill countries, in enterprises designed to rebuild the economic base along the lines I have discussed, will in the long run eventually solve the economic problems of that country. We need not delude ourselves; it probably will never be possible to raise the standard of living in the hill countries to that of the Corn Belt or the richer industrial centers. But there is a huge difference between a family income of \$200 a year and a family income of \$600 a year. I know hundreds of families to whom \$600 a year would be untold wealth and with which they could live wonderfully complete lives, far happier perhaps than their cousins in the cities with far greater incomes. I know from my own experience the possibilities of such an economy.

These are some of the things that I hope to see accomplished in the future as the result of this far-seeing program of forestry that you have before you for your consideration. Let us not look upon it as a job that can be taken up today and put aside tomorrow. Forestry is not that kind of a business. Forestry, to be successfully carried out, demands unremitting attention, continuous management, and in the sort of a rebuilding process that we are undertaking, it will demand steady and continuous investment of public funds. Face the facts and know that the money that you are expending is in the nature of an investment in futures, an investment in the rebuilding of an economic base on which we can maintain a population, an investment in the future avoidance of relief rolls. On this basis we shall succeed.

The issue is in the hands of the people of the State of Ohio. You are the leaders in forestry thought. It is up to you to see that these things come to pass. May I close with the quotation of an old proverb: "If you would have business done, go; if not, send."

Forest research in the Central States in contradistinction to forest research in some of our regions, deals with a territory in which the virgin forest is all but extinct. Therefore, comparisons with forests that represent climax types, or the apex of forest development, can very rarely be made. On the contrary, we have to deal with infinitely complex aspects of forest in all degrees of degradation and land that has been subjected to all degrees of use. I want to outline briefly, if I may, a few aspects of the problem posed by this complex set of conditions.

Since we are dealing with forests and lands that represent the end result of extremely variable impacts of the ax and the plow, our first over-all task becomes one of evaluating the results of these impacts upon the forest itself, its composition, its character, its growth capacity, and in the end also the impacts of use upon the regenerative ability of the soil itself with respect to forest growth. Study of the succession of trees divides itself logically into two parts. We can study the progressive degradation of a forest under overcutting, too much opening, burning and grazing, and find that we can outline a fairly steady progression from a composition that requires much moisture to a composition that requires much less moisture. For example, throughout the central hardwood region we have many sites on which we know there were formerly carried excellent forests of the so-called mixed mesophytic character with a composition including tulip poplar, ashes, some beech, some maple, and the higher group of species of oaks. Through successive cutting, culling, opening, burning, grazing, the site itself has been degraded to the place where it will no longer support trees that require as much moisture as did these former stands. The present cover is, therefore, composed of species of much lower moisture requirements--usually the hickories and the less valuable species of oaks. A great deal of our so-called oak-hickory forest at the present time represents a degraded mixed mesophytic forest.

Similarly, we have seen throughout the Corn Belt and through a great deal of the hill country a degradation from the true beech-maple forest to a mixed type including a great deal more of the oaks and hickories. On some sites, the natural moisture-retaining properties of the soil and situation itself has made it impossible, even with heavy cutting and heavy opening, to transform the forest to an absolute dry type of forest. In many of these situations we find the composition has changed merely to one of less desirable species due to the heavy overcutting and culling for the more desirable ones. Many of our heavy elm stands represent such situations.

To carry the cycle of degradation still further, we need to examine what happens when land has been cleared and subjected to agricultural use for greater or lesser periods. At the one extreme we have lands that have been cut and cleared and plowed for only a very short time. Perhaps the outstanding example of the ability of such lands to recover, if not too greatly subjected to abuse, is offered by a very well known piece of woods in southern Ohio. We have proof that this land was cleared about 60 years

^{1/} Paper read by Dr. Hall at Missouri Forestry and Wildlife Conference, Columbia, Missouri, May 1, 1941.

ago, cultivated for two years, and then abandoned. The sprout growth was evidently luxuriant, and the site had not been very badly degraded. The result was that a good forest of good composition came up. Two years ago, about 53 years after the initial clearing, the owner of this land was able to harvest saw timber from that particular tract from which he constructed an excellent house. Most of his timber that he used was yellow poplar, black walnut, and black cherry. He harvested only good-sized trees and, in truth, it could hardly be noticed that he had cut anything from the stand. This represents one extreme.

At the other end of the line of degradation brought on by ill-advised clearing and cultivation for agricultural use we find heavily eroded, barren sites that were formerly excellent hardwood forests. I have in mind a forty that was cleared by my father and two older brothers about 45 years ago. I know that an excellent stand of white oak was removed from this forty. I went back the other day to look at it, and it is barren. Oh, there is a sprinkling of sassafras and persimmon coming in, but it will be 150 years before it ever gets back into anything approaching a decent forest cover. On many of the south slopes where the soil was originally rather thin anyway, we have developed throughout the Ohio Valley lands that approach the glade lands of southwestern Missouri in character. The loss of top soil and the thinning of the soil mantle has made the site even much drier than a lot of our ridge lands. When it gets so dry, practically nothing will come in on these limestone lands except Virginia red cedar. As a boy I recall that there was practically no Virginia red cedar in our territory in southern Indiana. Now there are thousands of acres coming up to a thick red cedar growth. These, I'd say, represent actual glade lands brought about by the impact of agriculture upon submarginal land.

I think I have said enough to give you some idea of the complexity of conditions we face in our studies in forestry. We have, on the one hand, the task of trying to develop management practices for existing stands that have not been subjected to the terrific abuse represented by the opposite extremes of abandoned agricultural land. This in itself is a considerable task. On the other hand, we have the task of reforestation of abandoned agricultural lands and, in between, we have the job of fitting planting and conversion practices to very badly degraded forest stands that can be accelerated in recovery by such treatments.

I have not spoken at all of the economic obstacles that we face in some of these tasks. With some of them you are perfectly familiar. For example, we know that, over many millions of acres of hardwood territory, the residual culled and degenerated stand of hardwood is of such low use value that its removal confronts serious economic obstacles. It is easy to formulate practices from a theoretical point of view that would return such lands to productivity. The actual doing of them within economic limitations is not possible except under some form of Government subsidy. The same is true for the replanting and restocking of abandoned agricultural lands. I doubt if such operations could be justified on a single crop basis. We have to think of most of this sort of work as a pure reclamation job, namely, the bringing back into the field of human usefulness of lands that

otherwise would merely lie outdoors for several decades. We have to keep steadily in view the fact that we are working only to develop forests in the service of people. Forests in themselves are producers of wood for use, but that usefulness of wood has two objectives: first, supplying of materials for all people to use; and second, and to my mind most important, the production of opportunities for labor for those people that must live in the hill countries and attempt to make a living from the forest. When one considers that there are seven acres of good land in the Corn Belt for one acre in the hills, if measured on a basis of equal productivity, and in proportion to the number of population, one sees what the terrific impact of population on the resources in the hill lands really is. When one considers further that, in general, our forest lands are only producing about 10 percent of their potential yield, it becomes apparent that the opportunity for support of population in the hills has not yet been approximated. There are about 44 million acres of forest land in the region of this Station's responsibility. About 10 million of it is included in farm woodlots in the Corn Belt, and the remainder of about 34 million acres lies in the unglaciated portion of the territory.

We have several broad jobs that we are tackling. First, there is the over-all job of land classification in which many agencies are interested. In brief, we want to be able to delineate what land ought to be in forest and what land ought not to be in forest. When we have this classification as a start, we are trying to evaluate our forest lands from the following points of view: (1) What is there now on the ground? (2) What is the site capable of producing? and (3) What measures can be taken to hasten the development of the most productive forest of which the site is capable?

This program, briefly, involves economic analysis of the land, the development of management plans for restoring productive growth conditions, the development of methods of reforestation, and correlated with these tasks, methods of using low-grade material.

We have completed several studies in the past two years of the amount and kinds of defects in existing stands. We have found volume losses due to defects varying all the way from about 7 percent to much higher. Fire scars and decay of branch stubs are responsible for heavy losses. We have found that stump decay in trees arising from sprouts is actually only a negligible source of loss in some territories. The small loss in volume does not, however, give a true picture of the total loss in volume when the tree is worked up into lumber. We have not yet been able to carry through such studies except in one small study down in Arkansas, the results of which are not yet available. We hope to be able to study existing stands throughout the region in the coming years to determine the kind and importance of defect in the present overstory with a view to the development of more efficient means of utilization. We also expect to be able to use such information to properly orient and estimate the costs of various programs, public and private, that may be aimed at forest improvement in this region.

Our studies of Ozark stands show clearly that blackjack oak, while a real problem, is not as big a problem as it had been earlier thought. It seems to die out early and be superseded by more valuable stands. In short, it appears to be a transition species and may be a positive benefit to the forest by producing litter on dry, impoverished sites, and by

training the stems of other trees. Many seedlings are developing under protection in the Ozark forests. With the elimination of fire, we have every hope of seeing our Ozark forests start on the upgrade and make rapid progress. We have found also that we can profitably underplant some of these poor stands with pines, and have developed techniques for proper release of such underplanted pines by various types of cutting and girdling.

Numerous ecological studies have been carried out throughout the region. We have recently compiled a detailed map of the present distribution of shortleaf pine in Missouri, and are attempting to evaluate the factors that have brought about its distribution. We know that burning has caused a shift in the pine areas, and we know also that pine now grows in many areas formerly occupied by hardwoods.

We have many interesting things in the field of ecology and expect to have many more. Recently, a most interesting one came to light. It was found that elevational differences of as little as six inches in the old Illinoian glaciation of the Ohio Valley made a radical difference in the composition of the forest. Tracing the thing back to its causes, we found that seedlings of some species simply could not survive with their feet wet. A six-inch difference in elevation gave them dry feet and they came through. In other words, the composition of the forest itself is determined by the fate of the seedling and the kind of environment that it finds when it starts to try to be a tree. There are undoubtedly many examples of this sort of thing throughout our region. We have good information on some of them.

In the field of artificial regeneration, we have about come to the conclusion that we are in pretty good shape as far as the planting of pine is concerned. We know, for example, what the age classes of satisfactory seedlings ought to be within the species with which we are dealing. We have made a considerable number of studies on direct seeding and know about where we can expect success and where we can expect failure. Planting methods have been thoroughly studied and, in general, the region is getting good survival.

Planting studies in the field of the hardwoods are not nearly as far along. We do know that we can plant under certain types of cover, and that the kind of cover has a great deal to do with the kind of tree that we can expect to survive. We have studied, for example, a natural invasion of old fields in southern Illinois, and find that over a period of five years we can measure a large decrease in the amount of sassafras and a large increase in the amount of yellow poplar. These studies in natural succession and natural regeneration give us the very best orientation toward the type of artificial regeneration that we can expect to be successful. We have studied the soil-building properties of various species that either come in on old, abandoned sites, or can be encouraged through planting practice. We have found, for example, that while the pines produce more litter than sassafras or black locust, actually the fact that the sassafras litter enters the mineral soil as organic matter to a greater degree than does that of locust or pine makes it a rather

better species to induce the recovery of an old, eroded site than the other two. All three serve well, but we have learned, much to my surprise as an ex-hill farmer, that sassafras is actually a pretty good species to have around on old, abandoned land. After having spent a lot of my boyhood in grubbing sassafras in order to get it out of the corn fields, this did come as a distinct surprise. The reason for the influence of these species upon recovery is found both in the effect on the organic content of the soil and in the ability of the species to lay down litter that promotes infiltration of water. In general, the limiting factor in sites that determines the ability of hardwood species to survive is water supply in the soil itself. Old, abandoned sites too often shed the water in a manner reminiscent of a tin roof. Actually, by midsummer any vegetative growth that has survived is living under semi-arid conditions. Only by the rebuilding of cover, the establishment of shade, and the laying down of litter can a forest condition ever be reestablished.

I have been able to touch only briefly upon the various fields of work in which we are engaged. There are just as many that we cannot touch. We have some work going on in the field of economics, especially dealing with the farm woodlot conditions in northern Ohio and northern Illinois. We have known for a long time that the principal obstacle to the practice of forestry in the Corn Belt was grazing. So there is nothing new to say there. We have come more and more to the very definite conclusion that in the Corn Belt the woods owner must make a definite decision as to whether he is going to move in the direction of a productive forest or move in the direction of a pasture. The two do not mix very well. If he is going to move in the direction of a productive woods he must exclude his cattle. If he is going to move in the direction of a pasture, he might as well cut out his trees. However, it must be stated that the capacity for recovery of some of the badly abused forests in the Corn Belt is nothing short of remarkable. If the woods is not too far gone, and the sod is not too thick, and there is some reproduction, exclusion and protection will, in a few years, bring about a remarkable transformation in these woods.

In the hill lands proper, grazing is not quite the intense problem that it is farther north. Here, however, fire in the woods becomes a major enemy, and the composition of the present forest represents the effects of repeated burning, overcutting, and some grazing as I mentioned earlier in this paper. The first task there in management is to get protection from fire. If this can be done we shall have made the longest possible single stride toward recovery of a productive forest.

This, in itself, however, is not enough. As I stated earlier, we are dealing with a very badly degraded woods, composed of defective material and inferior species. I do not see how we shall ever achieve a productive forest within the time necessary to provide a living for the people that must make a living out of the woods, short of some form of Government investment. Whether that form of investment shall take the form of very easy credit, or straight-out subsidy, or public ownership I do not care to discuss at this time. Frankly, I despair of any form of credit accomplishing the task in a great deal of the territory with which

we deal. The forest is entirely too badly degraded, its productive capacity is too low to warrant expectation of the ability of the harvest itself to repay the total investment required to restore it.

Our task in research is to analyze those lands, find their conditions, find what we can expect from them in the form of recovery and yield so that we can give accurate information upon which to base public policies of the future.

LIMITATIONS AND POTENTIALITIES OF FORESTRY

IN SOUTHEASTERN OHIO ^{1/}

Land and People are the Basic Consideration

In addressing a meeting of the State Land Use Planning Committee I take it that we are all agreed that we cannot consider economic returns direct from land alone. Land use planning is only a part of a basis for community planning, and community planning is only a part of a basis for over-all governmental planning. Land use planning, therefore, to meet the requirements of the over-all process, must be geared to people--what they are, where they are, how they live, and how they can live.

From this point of view we need to consider briefly changes in the land use pattern, especially insofar as they apply to the territory under consideration. We are all familiar--some of us have seen--the land use pattern of the pioneer days and the earlier period when there was enough land and resources for everybody. Briefly, this pattern may be characterized by the general term "extensive use." The forest was still there and could be drawn upon at will for use and sale of products. Land that was cleared was land that could be used for the plow or for permanent pasture. There developed mineral industries and manufacturing industries that absorbed the growing population.

Then we move into a transition pattern that followed hard upon the first stages of forest exhaustion. Increasing population demanded immediate returns from land and a great deal of land went into agriculture, which we know now should not have gone into agriculture. We know the answer to such patterns of erroneous land use; we have them all around us. The answer is, finally, exhaustion of the basic resource--the land itself. We also know that in many of these problem territories where the proper use of rugged lands in support of people is of paramount importance, the normal increase in population is sometimes nearly double that required for replacement. Therefore, we can, I believe, safely say that the problems of relations of men to land in these rugged areas will progressively become worse rather than better, if left to the kind of aimless utilization that has characterized the past. That, I believe, is the basis for land use planning; a setting up of permanent land-use patterns that aim toward the fitting of the people and the land together into a pattern for permanent living. The questions we need to ask ourselves are: (1) What ought this land use pattern to be, and (2) What are the mechanisms that must be invoked for bringing it about?

Results of Past Policies, Especially with Regard to Forestry

I am going to deal, primarily, with the forest lands and the way I believe they can be fitted into the land use pattern of southeastern Ohio. It is necessary, first, to recognize that the forest as we see it bears little relationship to the forest that could be in southeastern Ohio. By that I mean, simply, that the forest, an organism that lives on land, is in no sense near its potential productivity. The reasons for the existence of

^{1/} Talk given before the Ohio State Land Use Planning Committee, Athens, Ohio, by J. Alfred Hall, September 11, 1941.

this situation in southeastern Ohio have been covered many times and I do not need to repeat them here. The fact is sufficient for our consideration. Supplementary to the low state of productivity of the forest is the lack of secondary wood-utilizing industries in southeastern Ohio that provide a market and consequently an incentive to the development of productive forests. Corollary to the fact that most woods operations in southeastern Ohio have been merely concerned with the extensive harvesting of haphazard virgin crops or second growth, is the fact that most farming activities on the available agricultural land have also been extensive in their nature.

In addition to the normal tendency of population in the hill countries to increase beyond the ability of the land base to carry them, we have also over-population resulting from the shrinkage of a mineral economy. The net result has been, in many areas, the bringing about of a population far too great for extensive land use policies. In General, as has been stated before, we find a ratio of crop land to population, computed on a basis of equal productivity, of about 1/7 that existing in the corn belt. On a comparable basis, therefore, it would require about seven times the land area to support people on an extensive farming basis in the hill section as would be required in the corn belt. I do not need to tell you that there is not that much land.

How Many People can be Supported on a Forest Economy?

If we consider the number of people that might be expected to be supported by a forest economy on an extensive basis, we need to consider only the amount of work required to log and mill lumber. I do not intend to consider the amount of labor required to do the ordinary stand improvement work in a forest because I am taking the forest as a productive unit already improved and a going business. The labor and capital required to do this job is a matter for another discussion. Assuming therefore that our forest is already on a basis of sustained yield and that we know how much we can harvest, on a continuing basis, I find that as an over-all average it requires about 4 man-days to log and mill 1,000 feet of lumber. A little less than half this amount is required in logging itself.

Consider now that we want to furnish 200 man-days a year of work to the individual. That much can be gained by useful woods employment for current income purposes. Consider now that we are going to grow 200 feet of sawtimber per acre, and disregard attendant by-products such as fuelwood, wood for distillation, etc. It becomes apparent that it will take about 5 acres to produce 1,000 feet, and it will take 50,000 feet to furnish a man-year, or about the product of 250 acres of woods. Now, what did we gain in the way of cash return to the land and ownership? In the first place, we get stumpage for 50,000 feet, which I am setting up at \$10 a thousand or equal to \$500 which can be returned to land ownership. In addition, we have 200 man-days of work at \$3 a day or equivalent to \$600, a total of \$1100 that we can assume as a cash return from growing trees on 250 acres of hill land in one year.

The weak spot in our argument is that we have considered only an extensive type of forestry in which all returns will be to land ownership and to the rough kind of labor required to harvest and mill rough lumber. I need not also point out to you that that kind of forest utilization is principally the kind that we have had in southeastern Ohio during all past years. The production of cross-ties and rough lumber cannot furnish the labor reservoir required to take care of our population.

Possibilities in Secondary Manufacturing Industries

One advantage in contemplating a partial forest economy for southeastern Ohio lies in the large possibilities in the development of secondary manufacturing industries that use wood as raw material. We have ample evidence in nearby regions that such hardwood industries do offer an exceptionally stable economic base for community life. We have found, in making analyses of such communities, that a thousand feet of good hardwood lumber can furnish or rather does require a man-month of labor in further manufacture. If, then, we assume half of the board-foot yield to be suitable for such manufacture, in a county of 300,000 acres, of which 40% is forest, we will find that 120,000 acres will produce at a growth rate of 100 feet per acre per year, an annual yield of 12,000,000 feet of utilizable lumber.

At the above discussed rate of 4 man-days per thousand engaged in logging and milling, we will have 48,000 man-days or, at 200 man-days per year, 240 man-years. If we give each man four dependents, we will find the logging and milling phase supporting 1200 people. If we put four people into the picture for services, we will have 960 more, or a total of 2,160 people that can be supported by this 120,000 acres on an extensive basis of logging and milling alone. That does not mean much to a county with 12 or 15 thousand people in it.

If, now, we take that 12,000,000 feet of good lumber, or even just take 6,000,000, which we are going to use in intensive manufacture, we find that 6,000,000 feet will require 6,000 more man-months to be superimposed upon the logging and milling requirements. On a 12-months basis, which would be required for decent factory operation, we would have 500 man-years. Figuring on the same basis as before, we have an additional 2,000 population for dependents and 2,000 in service, which will give us another 4500 people altogether. Add that to the 2,160 which we had above, and we have a total population supportable on 120,000 of about 6,160.

It must be remembered that I am contemplating taking care of this number of people by intensive development of forestry on 40% of the land area and superimposing upon the ordinary requirements of forest management, logging and milling, intensive secondary manufacture. This still leaves 60% of the land area for subsistence farming and grazing and agriculture of various sorts. I believe this sort of a land use pattern can take care of some counties. In some others, with a very heavy stranded industrial population, other means would have to be found to work out the problems.

What are the Requirements for the Development of Intensive Forest Economy?

In order to develop an intensive forest economy such as the one I have described above, there are certain things that will have to be. First, ownership must be stable and possessed of a clear objective. In other words, there can be no room for anything but long-range management with an objective of continuous sustained yield of forest products. Plans for such management can only be based on a permanence of tenure and a stability of tenure that do not now obtain.

If such tenure is to be accomplished in this territory, I do not believe that it can be accomplished on units of much less than 275 to 300 acres in extent. The argument in support of this was adduced when I calculated the stumpage return plus logging and milling return on a unit basis. If we believe it possible to achieve a land ownership pattern along this line in this territory, where, as you all know, the unit of ownership is now much smaller, we will all agree that a private ownership economy of forest land is possible throughout.

Because I do not believe that such a pattern of ownership is possible to achieve on a lot of the poor land in southeastern Ohio, and because the degraded condition of the forest on much of such land makes inescapable a long period of investment of some sort in order to return the forest to productivity, I believe that extensive public ownership of such lands in southeastern Ohio is unavoidable. The history of private ownership on small holdings in southeastern Ohio and in all other parts of the United States that correspond to it, has been a simple one; (1) in bad times, owners overcut the forest in order to get a living; (2) in good times owners overcut to get a small immediate profit.

There are enough examples in the hills of Lawrence County right now of destructive cutting for a small immediate profit to give any forester heart-failure about the prospects of good forest management in that territory for a long time to come. I do not know how widely spread this is in southeastern Ohio. I have seen these examples myself. I do know that throughout the hill territories of the Ohio Valley, the Ozarks, and the Cumberland, we are in a period of accelerated over-cutting during which the growing stock that had been built up during the depression to a very small degree will be destroyed and the forestry program in that territory correspondingly set back.

An intensive program of forest management demands certainly the foregoing of immediate returns to insure larger future returns. Because this is true, and especially true in rebuilding an overcut forest, there is required an investment of capital either in waiting capital or actual current expenditures. If private enterprise can do this on large areas of badly degraded forest, all well and good, but I firmly believe that only the Government can carry the burden. Private ownership can make the grade where: (1) Ownership is sufficiently large and the forest is in fair productive condition; (2) If government grants credit facilities where they are needed; and (3) if intensive extension work is done.

I do not need to point out that actual forestry extension, especially in southeastern Ohio, has been entirely inadequate in the past. I confess that I am not very optimistic about the prospects for great returns from extensive expansion of educational work in forestry, where small ownerships and poor people combine to make an exploitive economy unavoidable.

It will be noted that either or any of these programs or parts of programs that I have discussed will require investment of money in some form or other. I do not think it is necessary to sidestep that fact. Where it has taken a hundred years to get a country into the condition in which we find a good deal of southeastern Ohio, it is idle to expect to get its rejuvenation and return to prosperity, short of some form of investment. I ask this question, however. Is it fair or even logical to expect the heavy investments that are going to be required to restore this country--whether Federal or State funds are used--without asking some guarantee that forest practices on private lands will be in the public interest? I construe the public interest to be the continual furnishing of adequate raw materials for the maintenance of local industries. In the past, the forest has been considered as a reservoir of raw materials available to anybody for the taking. In the future, it must be considered as a continuous producer of raw materials on an intensively managed basis. These raw materials must be considered as the basis for the establishment of secondary industries from which people can make a living. The guarantee of this continuous flow of raw materials is the most essential thing in the establishment of a stable and permanent forest economy.

In considering the impacts of the post-war period, I believe we must frankly face the following near-certainties: (1) There will be again a return of industrial refugees to poor hill land; (2) there will start again the cycle of ill-advised land clearing and forest destruction that has characterized the past few years; (3) both of these processes merely degrade the already-degraded resources without doing anything to establish a permanent economy.

I have recently cooperated with other Departmental agencies in preparing two definite programs for present experimental work, looking toward the possibility of establishing the type of industrial forest economy I have attempted to portray above. In one of these, we are going to try to pick out typical areas in which to establish, experimentally, a type of horizontally and vertically integrated forest utilization that will take advantage of all of the possible products of the forest. By horizontally integrated I mean the establishment of all types of forest industries capable of utilizing the raw material that the forest itself produces. Instead of only lumber mills cutting high grade lumber for furnishing to an industrial community somewhere else, we shall expect to have secondary manufacturing industries established within the community itself to take advantage of the raw materials produced in the community. In addition to those industries utilizing high grade wood, we shall expect to have pulp mills, distillation plants, specialty manufacturing plants, wallboard plants, plastic plants, or such other conversion agencies as may be indicated by the type of forest under consideration. The capacities and nature of such industries will be geared to the actual nature of the raw material. That is what we mean by horizontally integrated industry.

Industries will be vertically integrated in such a way that the waste or rejected products from one industry will become the raw material of a second. We have numerous examples of partial communities in this country already built upon this pattern.

Such an experimental set-up will be in the nature of a pilot plant with two objectives: (1) The working out of the engineering application of new technical processes in wood utilization that are already available; and (2) the working out of the economic relationships involved in the establishment and maintenance of such forest communities. It is now that this sort of work ought to be going on in order that when the expected wash-out comes, in post-war days, we shall be on a sure basis when the call comes for public work programs of this sort or another.

Conclusions

I have tried to indicate, briefly and sketchily, how I believe we can visualize the use of the available productive forest capacity in southeastern Ohio as a living base for people. I have indicated that I believe that a large proportion of the forest land in southeastern Ohio ought to be in public ownership, and that of those lands that remain in private ownership--forest lands I mean--the Government in return for services in the form of credits and technical services ought to require guarantees of the right sort of cutting practices that will maintain such lands in productivity forever. These things I believe to be definitely in the public interest.

I am aware that many of you disagree violently with any increase in the forms of Governmental regulation. I believe you will agree with me, also, that a democracy can regulate itself as it pleases. The type of forest regulation that I am proposing is only a part of the educational process that many of you advocate. It is, in effect, the essence of democracy, for democracy can live on only the basis of plentiful supplies of raw material. When people are hungry and bereft of opportunities to work dictatorships develop. Therefore, I conceive that regulation of cutting practices on forest land is the expression of the will of the people that they may continue to have abundance of raw material upon which to labor. As such I conceive it to be not only democratic in itself; it is one of the things necessary for the preservation of democracy.

FORESTS AND FARMS IN SOUTHEASTERN OHIO ^{1/}

I esteem it particular pleasure to be called upon to address a group of bankers, especially a group of bankers that come from towns and cities representative of a territory in which I am deeply interested. Southeastern Ohio is a country of tradition--the first country settled in the Northwest territory; settled by people of high ideals and fine historic background. For many years they were able to hew a living from the God-given resources of a rich land, and built a thriving and apparently permanent civilization. We have seen, however, within the past generation, things happen to southeastern Ohio that give us pause and cause us to wonder if we have built wisely and well.

Perhaps it would be well to retrace a little of the economic history of southeastern Ohio before we discuss the subject that I have been called upon to talk about here tonight. As you know, I am going to talk mostly about forests, and I propose to talk about forests in their relationship to the past history, the present and the future of southeastern Ohio. Before taking up that subject, however, let us consider for a moment just what was the basis for the establishment of the economic life of about 27 or 28 counties in southeastern Ohio.

When our early pioneers came across the Ohio, they found a land almost entirely covered with virgin forest. In common with their cousins and brothers who settled almost the entire middle west, they found the forest to be a foe. The demand in those days was for food and lots of it, and so the forest all over the middle west was cleared, primarily for the purpose of winning land for the production of food. You and I know that your grandfathers and great grandfathers and mine cut and burned timber that would now be worth millions of dollars on the market. We should not criticize. Under the circumstances we would have done exactly the same thing. However, there is a distinct difference in the pattern of subsequent development of southeastern Ohio as compared with certain other parts of the middle west. Southeastern Ohio found itself in possession of rich deposits of iron ore, vast deposits of coal, vast deposits of clay that could be worked into tile and various ceramic products, brine that could be used as a basis for chemical industry. All these things went together to develop an industrial civilization in southeastern Ohio, quite in contrast to the type of civilization developed in most of the Ohio Valley. The natural result, I suppose, was that men learned industrial arts, learned the finance of industry and forgot the land. The forest itself became merely a tributary to the rising and thriving iron industry. We know that most of the virgin forests of southeastern Ohio went into the manufacture of charcoal for the production of pig iron. With the development of cheaper iron ore in greater deposits in the Superior country, the iron industry of southeastern Ohio went out. Then the forest had a chance to recover. In the meantime, however, a vast amount of land had been cleared for agricultural use, which we now know was too steep to ever have been plowed successfully, and much of which has now passed out of agricultural use. The forest had never become recognized as a base, or even a potential base, for the existence of industry.

^{1/} Talk delivered before Group 7 of the Ohio Bankers Association at Zanesville, Ohio, August 25, 1941, by J. Alfred Hall.

Coming down to later years, we do not find too pleasant a picture of economic life in southeastern Ohio. In short, our industrial civilization suffered during the last ten years, and we have found that it does not offer a permanent base upon which our people can live. There is no use in deluding ourselves. Unless our industries in southeastern Ohio can compete in the open field with the industrial set-ups in more favorably situated territories, we shall continue to have many people in southeastern Ohio who cannot find jobs. The picture of the relief situation in these counties has not been good during the past ten years. I merely need to cite to you the fact that \$15,000,000 in relief were plowed into 13 counties of southeastern Ohio in the year of 1939. You and I know that that merely results from the fact that we have people and not jobs enough upon which to keep them employed.

You are the financial leaders of your communities. It is your function in community life to regulate and control the flow of credit into productive enterprise, upon which people can live. You lead in the development of new enterprises within your communities. You lead, or should lead, in the thought of your communities as regards land use. I wonder, though, how many of this group of intelligent men, entrusted with these responsibilities within their communities, have really given thought to what has happened to the land base in southeastern Ohio, and to the forest resource that should form a large part of the economic base of southeastern Ohio. And that, gentlemen, is the subject to which I want to address myself this evening.

Now, before I start talking about how I think a forest and the forests of southeastern Ohio, can be fitted into the economic life of southeastern Ohio, I want to give you my conception of just what constitutes a forest. I know, because I have heard hundreds of business men make the statement, that in the minds of most men of financial affairs, the forest is not considered as very much of an investment. The usual explanation is, "Why put money into a forest when it takes a hundred years to grow a tree?" That is based upon an utter misconception of what constitutes a productive forest property. It is perfectly true that if I start today with seed on a barren piece of land, and wait for that seed to grow up into a sawlog, it might take a hundred or even 150 years. But that is not the way we run a forest.

I am aware, also, that many intelligent people have, through various avenues, obtained a complete misconception of what we mean by forest conservation. Many years ago, because of the quotation of a certain European law, it became rather commonplace for people to say that in this country if we were ever going to have perpetual forests, we would have to enact a law to make anybody plant a tree every time he cut one down. Well now, gentlemen, that really is just a little bit silly. In the first place, let me point out to you that our virgin hardwood forests, the forests that we sometimes lament having passed away from southeastern Ohio, only had a few big trees per acre. Those huge trees represented hundreds of years of striving for a place in the sun, competition between countless trees, and for one tree that grew up to old age and maturity, there were hundreds that passed out along the route. Yet, everyone of those hundreds that passed out along the route contributed something to the production of that beautiful

giant that our grandfathers or great grandfathers found and harvested. A forest is a very complex biological organism. It is not something that you can have by buying machinery today, turning on the power tomorrow and expecting an output of finished goods day after tomorrow. To have a successful forest we must start planning about a hundred years ahead. Now, let me explain that just a minute.

Look around you at a hardwood forest that has not been too badly treated. You will probably find in it trees ranging all the way from probably 24 inches in diameter down to little seedlings that are just struggling up through the leaf litter. Between those two extremes you will find everything from the size of a pole to a sapling, and every conceivable size class. Now we're going into that forest and we're going to try to harvest that which ought to be harvested. Well, there's only one answer to that. We ought to take out of that woods just the old, mature trees. Why? Well, in the first place, they are not growing. They are just like you and I; when we get old, we quit having any ideas. That tree that is standing there and looks green and nice but is 36 inches in diameter probably isn't putting on any wood at all. Therefore, it is not earning any income; therefore, it should be cut. And, like some of us when we get to be 75 or 80 years old, we probably ought to get out of the way and make room for the young fellows that are coming along. Well, the same thing is true of this big tree. It is not growing, but it is occupying a lot of room, using up a lot of light, taking a whole lot of water that could more profitably be invested in young, growing trees. Therefore, in managing a hardwood forest the first thing we've got to get into our minds is that we harvest the old trees when they are mature and get them out of the way so that the young stuff can come along. Now, if we have the proper makeup in this woods - big trees, middle-sized trees, little trees and seedlings - as we harvest that old tree, it won't be very long until a young one will have come up, filled in the gap that we left when we harvested the old one, and begun to grow rather rapidly into a pretty good sized tree itself.

The picture that I am trying to paint to you is of a managed forest; one that we are managing in such a way that it produces annually a finished crop of old trees. If we do that thing properly, every year on the average, we can harvest something from almost every acre of our woods land. It may be just one tree that will represent the harvest for that one year. Or it might be two trees, or it might be no trees, but on the average, over every acre of a forest property we ought to be able to take off each year the amount of wood that that forest property grows each year; taking it out in the form of mature timber; never cutting the young stuff or the intermediate growth that is putting on wood. Now do you get what I'm driving at? It would be about the same as if I were running a dairy herd. Some of you fellows undoubtedly are farmers on the side. I've known lots of bankers who farmed on the side, so as to make a living! The best way that I know of to run a dairy herd is to sell off the old cows when they get up to the place where they don't milk very well, and always have a bunch of young heifers coming along to keep the herd stocked up. An even-aged dairy herd is not a very good dairy herd, because they are all likely to go out of production about the same time; unless you have had your young stock coming along, all of a sudden you find yourself without any growing stock - nothing to produce. Well, now, that's about the way we've handled our woods

in southeastern Ohio so far. We've not only cut off all the old stock, but we've also cut off all the growing stock as time went on, so now, when we take an inventory of our forest stock, what do we find? We find a bunch of old stuff standing around in the woods, fire scarred and rotten, growing nothing. And underneath a bunch of suppressed young stuff that hasn't a chance to really grow into something worthwhile. Or, on some of the lands that have been clear cut for charcoal production or that have been butchered for other purposes, we find that both the old stock and the young stock have been cut off and now all we have is a bunch of poles and saplings with nothing that we can think of harvesting for about 40 years yet. Both systems are poor from the standpoint of continuous yield of raw material; and, gentlemen, I cannot emphasize this point too much, the only way you can run a forest property so as to make it a paying investment, both for the owner of the forest property and for the people who depend on it for jobs, is to run it so that there is a continuous flow of finished logs from that forest property that can go out into industry.

Now that brings me down to the meat of this discourse. If there were nothing to the managing of forest properties in southeastern Ohio except the production of sawlogs, I would not be interested in it very deeply from the standpoint of community welfare and life. The reason I am interested in forests as a basis for living in southeastern Ohio, is because they produce a very important and useful raw material for industrial conversion. That's where the towns come in and that's where I think we can do something about building back an industrial base in southern Ohio to take the place of the industrial base that has gone out on us in the last 25 years. One advantage in contemplating a partial forest economy for southeastern Ohio lies in the large possibilities in the development of secondary manufacturing industries that use wood as a raw material. We have ample evidence in nearby regions that such hardwood industries do offer an exceptionally stable economic base for community life. We have found, in making analyses of such communities, that a thousand feet of good hardwood lumber can furnish, or rather does require, a man-month of labor in further manufacture. If, then, we assume that in a county of 300,000 acres of which 40% is forest, we will have 120,000 acres of forest that will produce at a growth rate of 100 feet per acre per year, we ought to have an annual yield of 12,000,000 feet of utilizable lumber. Now, if that lumber in secondary manufacture requires even four man-days per thousand in logging and milling, that makes 48,000 man-days, or, at 200 man-days per year, 240 man-years. If we give each man four dependents, which might be a little low in the hill country, we'll find the logging and milling phase of the industry supporting 1200 people. If we put four people into the picture for services, we'll have 960 more, or a total of 2160 people that can be supported by this 120,000 acres on an extensive utilization basis of logging and milling alone. Well, that's pretty good, but it isn't enough, where you have a county with 12,000 to 15,000 people in it.

Now let's take that 12,000,000 feet of good lumber or even just take half of it, after we have sorted it and culled it out, and use that six million in intensive manufacture. Then we'll require about 6,000 more man-months of labor in secondary manufacture, to be superimposed upon the logging and milling requirements. On a 12-months basis, which would be

required for good factory operation, we would have 500 man-years. Figuring on the same basis as before, there's an additional 2000 population for dependents, and 2000 in the service, which will give us another 4000 people altogether. Add to that the 2160 we had above, and we have a total population supportable on 120,000 acres of over 6100.

Now you must remember that I am figuring on taking care of this number of people by intensive development of forestry on 40 percent of the land area, and superimposing upon the ordinary requirements of forest management, logging and milling, intensive secondary manufacture. That still leaves 60 percent of the area for subsistence farming and grazing and agriculture of various sorts. I sincerely believe that this sort of a land pattern can take care of some counties. In some others, with a very heavy stranded industrial population, other means may have to be found to work out the problem proposed.

Now some of you may be wondering just how we shall ever achieve any such forest economy in southeastern Ohio, considering the fact that we have a huge population down here that must be taken care of now, and by the very most conservative estimate, it will take 40 or 50 years of intensive effort to get our forest properties into the kind of condition I am describing. In other words, this is all very nice as a picture of what might happen, but, you ask--and perfectly justifiably--"Here we have a good many thousands of people who have to eat now and for the next forty years. What are we going to do about it?"

All right. Let me answer your question in one simple paragraph. It took about 125 years for my folks and yours to get this country in the shape it's in, down here. It has supported a lot of people during that period. We know now that we have milked it almost dry. Is anybody so naive as to think that we can reconstitute this economic base down here without spending some kind of money on it? We cannot continue to milk a country without finally coming to the end or investing some kind of money in rebuilding the resource. Let me spend just a few minutes in discussing the mechanisms by which we can go about rebuilding the resource, and let me emphasize this one point first. Either we are going to rebuild a forest and land resource in southern Ohio, or we can contemplate a long period of perpetual relief in some form or other. Public policy has its choice. It can perpetuate relief in southeastern Ohio until people get so tired of being on relief that they either die off or move out, or we can begin to take active steps toward rebuilding a real economic base. Now, how do we go about that second job? - because I don't believe that anybody in this crowd would agree that we want to even contemplate a perpetuation of the sort of economic whirlpool in which we have been cast during the past decade. You know what I mean by "whirlpool" - you go round and round, getting nowhere.

In the first place, I ask you to consider, candidly and calmly, the fact that there is a lot of land, I don't know how much - probably about a million acres, in southeastern Ohio, that is not fit for private ownership. Now I know perfectly well that to many of you that is a violent disruption for most of your old ideas. As a matter of fact, when I first ran into it it was pretty hard on me. But I ask you to believe that I've

given a lot of thought to this problem and I am now giving you the result of rather mature consideration. Look at your tax-delinquent lands in southeastern Ohio, and then think about what causes them to be tax-delinquent. As nearly as I can make out, when lands go tax-delinquent, they've got to the place where they no longer earn their taxes. Well, you have a lot of land in southeastern Ohio now that is not earning its taxes. Most of it is in some sort of second-growth timber, or it's abandoned agricultural land that ought to be in timber. Now what are you going to do with those lands? Let them lie idle, let them lie tax-delinquent, or sell them at tax sales for somebody to go in and skin and keep on going down hill; or are you going to put them under some sort of management? And if you want to put them under some sort of management so they can return some economic return to the people in the community, just what sort of a mechanism do you propose outside of public ownership? Frankly, I don't know any other alternative.

As you may know, we have started a public purchase program for such lands in southeastern Ohio. Eventually we propose to have a National Forest in southeastern Ohio, managed primarily for timber production; and when I say "managed for timber production" I mean for the kind of sustained yield timber production that I've been talking about here before. I mean that we intend to have in the long run, from those lands, a perpetual flow of raw wood material upon which we can build a base of forest industry. And, let me repeat, you cannot build a permanent secondary forest industry upon any base except a continuous sustained flow of raw material. You might ask, "Well, why, if the Government can do this, can't private capital do it?" I don't say it couldn't, but I will say that it hasn't, and so far I see no indication of its anxiety to do the job because, gentlemen, this job that we're talking about is going to require a wait of about 40 or 50 years before anybody is going to get any returns to amount to anything from the land that we are going to try to get back into production. Now, I know and you know that your Board of Directors is not going to be very much interested in that kind of a proposition, from the standpoint of the investing of bank funds. I doubt if any of you gentlemen, good business men as you are, would be particularly interested in buying up a bunch of this land at the present moment and waiting 40 or 50 years before you began to get any income from it. No, gentlemen, the returns on the invested capital are not going to be high for a good many years to come.

After we have restored the resource--after we have got our forests back into growing condition and can begin to harvest at a good rate--then I think I can guarantee you that we can harvest from these lands at the rate of somewhere between 100 and 200 board feet of useful raw material per year. At present stumpage rates, those figures will mean somewhere in the neighborhood of \$1 to \$3 per acre per year in return to land ownership itself. The Government will actually reap a large reward for this enterprise. In passing, it might be well to point out to you one or two features of national forest policy that do have some significance to local government. Stumpage sales--returns from stumpage sales--to the Forest Service are divided 25% to the county in which the sale is made, and 75% to the Federal Government. A further 10% of the sale returns go to the counties for schools and roads. I am quite sure, therefore, that in the long run the counties will get a much greater financial return from these

lands in Federal ownership than they are now getting from tax-delinquent land. There is, of course, the further fact, as I have tried to point out above, that there should grow from the raw material harvested from these lands a very large return to communities and, of course, indirectly, to local governments, from the establishment of permanent forest industries that pay wages. Those things, I think you will agree, are well worth contemplating as a future return on public investment, and on those bases, I think you will agree, public investment is amply justified.

There are, however, jobs to be done in the meantime in getting this forest into condition. There is defective timber that must be harvested, and it must be manufactured into whatever it can be manufactured, sometimes perhaps at a loss. There is the forest to be protected against fire. There are stand improvement jobs and various sorts of things to be done perpetually in maintaining this forest and bringing it along toward productivity. Those jobs ought to be furnished by either the Federal or the State Government from appropriated money on a permanent basis for forest residents. I think you will agree that we might make a pretty good investment of money in that direction, aimed toward the rebuilding of a permanent base, rather than some of the ways in which we have spent public money in the last ten years in the guise of this or that form of relief.

Now let me suggest one other thought for you to carry away. I know and you know that we are living in an age of increasing governmental regulation of private affairs. I don't know how to avoid it any more than you do. But my job is thinking about forest lands and I have done a lot of thinking about them. I ask you to look around you in southeastern Ohio and see what private ownership of forest lands has done to the forest. The plain truth of the matter is that our lands in southeastern Ohio are split up into small ownerships and most of the fellows who own these little patches of hill land are poor. About the only thing they have to sell sometimes is what they can cut out of the woods and about the only market is some form of crude utilization like mine props or cross ties or cord wood. The net result is that they cut everything that can be cut during poor times, in order to get enough to eat, and then when times are good, they cut everything that can be cut in order to make a little money. It all adds up to the fact that your forests, all over southeastern Ohio, have been sadly overcut for at least 75 years. By overcut, coming back to the earlier part of our discussion, I mean that we have always cut the growing stock, at just about the time it began to put on value. Now that must be stopped or there will never be a productive forest in southeastern Ohio, and there can never be a secondary industry superimposed upon it, to which I have referred rather lengthily above.

I ask you, therefore, to consider: "Is it good social policy to permit the continuation of practices on land that lead finally to the degradation of the land itself, to the exhaustion of the forest, and to the complete absence of any opportunity for productive employment on products from the land?" If you believe that is good social policy, I am afraid you and I have very little to discuss. If you will agree that there is something wrong about such a social policy, let me suggest this:

We are proud that we are a democracy. We believe that we are justified in fighting a war to preserve our right to think and do as we please. As a matter of fact, we are talking about spending a hundred billions of dollars right now in fighting a war for the preservation of our right to govern ourselves the way we want to govern ourselves. Did you ever stop to figure out just how much of an investment that means in terms of acres of land? Well, we have about 2,000,000,000 acres of land in the United States, and so we are going to spend \$100,000,000,000 in defending our right to do with that land as we please. That's at the rate of about \$50 an acre. I suspect that if you could sell southeastern Ohio land--all of it-- for \$50 an acre right now, it would be a very good sale. And yet we're willing to spend \$50 an acre just to decide that we can do with it as we please. All right, we've been doing with it as we pleased for the last 150 years. Look at the shape it's in. Do you want to go ahead and leave things in that way?

Let me suggest this thought to you. Did you ever stop to consider that a democracy, much as we love it, really couldn't exist except upon a basis of almost limitless natural resources? You can't have a democracy in a land of poor people without jobs, with hungry bellies and no hope for the future. That sort of a country breeds dictatorships. Isn't it a good idea then, for a democracy to begin to take some thought looking toward the preservation of those boundless resources with which the Lord blessed it. For that reason, many of us have come to the conclusion that because the forest and the products of the forest are important in the continuation of an abundant civilization in this grand country of ours, that it has come to the time when we must take thought about how those forests are going to be handled. No longer can we permit the sort of unregulated devastation in cutting that has gone on during all the years of our history. No longer can men be allowed to go ahead and do as they please on a piece of land just because they happen to have a deed in fee simple. I ask you, and I want to leave this one thought with you, "Is it time, now that we've come to the crossroads and we know that we're going to have to fight in order to preserve our type of civilization, isn't it time to begin to take thought also toward this fundamental basis of our type of civilization--the perpetuation of an abundance of economic goods upon which a democracy can live.

There is nothing new about the concept of regulation of the right of a man to do as he pleases with a piece of land. I suppose a good many of you, as have I, have tried to build a house in a city at various times, on a lot that I owned in fee simple. I owned the top side, bottom side, up into the air and down into the ground. But--when I started to build a house I find I run against a whole lot of things. I've got to build it so far back from the sidewalk, and I've got to build it so far in from the lot line, and I've got to have a sewer connection, and the public insists on inspecting my plumbing and inspecting my wiring, and as a matter of fact I can't even build the kind of a house I want to, because the community has a committee on architectural design and they tell me what kind I can build. They even tell me how much I've got to pay for it. Well, they're certainly trampling a whole lot on my personal liberty, but after all, all the folks around in the community have decided that that's the way they

want to run this house business and if I want to live in that community, I'm going to conform. Well, now, it isn't a very long stretch of imagination from that to coming into a man's forest and telling him that he must cut that forest in such a way that the public interest is served. Because, gentlemen, if I have made any point here at all tonight, I have tried to give you the conception that the public does have a big stake in how a piece of forest land is managed. The public loses when you cut growing stock and set back the growth of that forest 40 or 50 years. The public loses when a tract of forest land burns and sets back the productive capacity of that piece of land in forest products for a hundred years. The public loses all along the line, because not only has it lost a beautiful thing to look at, not only has it lost a place to fish and hunt, not only has it lost watershed value, but the important thing is that it has lost production of raw materials that mean jobs to people. Now, that gives the essential thought that I wanted to get across to you tonight. Look at your land in southeastern Ohio from a standpoint of what it can be made to produce in terms of jobs for folks--and I don't mean coal and iron and clay and brine. I mean wood.

